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## PROTECTION DEVICE FOR A VEHICLE ROOF

The technical field of the present invention is that of mechanical and electromechanical systems, and more particularly, the application of these systems to armoured combat and security vehicles.

The present invention relates to a ballistic protection device applied to combat and security vehicles. Indeed, in order to counter certain threats (hollow charge bomblets, explosively-formed charges, kinetic projectiles) able to perforate great thicknesses of armouring, the thickness alone of the material constituting the roof (aluminium alloy, steel armour, composites) is not enough. Additional add-on armour is thus required. According to the threat such additional armour may be of a different kind: passive composite armour or reactive armour. It may be in the form of plates or bricks that are fastened to the roof of the vehicle. However, the roof of a combat vehicle, and in particular the roof of its turret, houses a certain quantity of equipment whose very presence makes it impossible or difficult to install such additional protection.

Ballistic protection systems for the roofs of armoured vehicles are known, namely by patent US-5105714. This patent proposes a foldable device to protect the crew's access hatches.

A device is also known that is used on a known tank and consists of an armoured hatch sliding on rails.

A first disadvantage in the protection technique currently used remains in the fact that the hatches allowing crew access to the interior of the vehicle are manipulated by the crew's own strength. The increase in mass due to add-on armour may prevent this manipulation and lead to the adoption of costly and complicated opening and closing assistance devices for said hatch.

Another disadvantage of the system proposed by patent US-5105714 and of that applied to the known tank lies in the fact that these devices limit the roof's protection to that

of the reduced area of the access hatch and do not allow the cover the whole of the crew's station.

Another drawback to the known tank is that the sliding hatch system is very heavy. Opening and closing times are  
5 long and hardly compatible with the operational use of a combat tank.

The aim of the present invention is to supply a protection device enabling the afore-mentioned drawbacks to be overcome.

10 The invention thus relates to a roof protection device for an armoured combat or security vehicle that uses at least one protection means, wherein it incorporates a structure to receive the protection means, said structure being mounted  
15 able to rotate on a support integral with the roof so as to occupy an active protection position and a passive position in which it is moved aside.

Advantageously, the reception structure is articulated with respect to the roof by means of a bracket fastened on said roof.

20 Advantageously again, the height of the bracket is calculated so as to avoid any interference with the operational devices fastened on the vehicle roof.

Advantageously again, the reception structure is rotated manually and/or using motor means.

25 According to one characteristic, the device incorporates means such as a spring, counter-weight, pressurised gas, battery, capacitance or equivalent system to store part of the energy required for the device to be moved from the passive to the active position.

30 According to another characteristic, the passage from the active to the passive position is carried out without any energy from outside the system being required, and is obtained using the stored energy.

35 Advantageously, the protection means are of the ballistic type and are constituted by at least one armour plate and may be in the form of armoured elements fastened to the reception structure.

According to one characteristic, the protection means are constituted by elements that reduce the electromagnetic signature of the vehicle.

According to another characteristic, the device is  
5 fastened onto the roof in a removable manner so that it may be separated.

The invention also relates to the application of the device to the protection of the openings of the vehicle, such as access hatches, GMP hoods, or maintenance hatches.

10 Other characteristics, particulars and advantages of the invention will become more apparent from the additional description given hereafter of the different embodiments given by way of illustration in reference to the drawings, in which:

- 15 - Figure 1 shows a front view of the protection device,
- Figures 2a and 2b show the protection device, in its single plated version, mounted onto a tank turret,
- Figure 3a shows a top view of the protection device, in the disengaged position,
- 20 - Figure 3b shows a top view of the protection device in position above the zones to be protected, and
- Figures 4a and 4b show front and side views of the protection device in position over the zones to be protected.

Figure 1 shows a first embodiment of the protection  
25 device 1 of the roof 20 of a vehicle, not shown, in a double plated version. We see that the device is composed of an articulated plate 7, constituting a reception structure, onto which armouring elements 2 are fastened. The plate 7 is kept at a distance from the roof 20 to be protected by means of a  
30 bracket 3 fastened to this roof. A support 4 may be positioned between the plate and the roof to help keep the plate in place and neutralise any overhang. The displacement of the plate carrying the armouring is carried out by means of a rotation mechanism 5 that may be manual or motorised  
35 (for example using an electric motor). Given that the plate is positioned above the crew's access hatches (not shown in this Figure), for safety reasons, it has been planned for the energy required to disengage the plate, allowing access to

the hatches and their opening where need be, to be stored in means provided to this end: spring, counter-weight, pressurised gas, batteries, capacitance, or any other equivalent system. These energy storing means 6 are linked to  
5 the motorisation system 5 activating the plate by simple command from the crew. As will be explained hereafter, the plate may occupy an active protection position and a passive position in which it is moved aside from the roof. The height of the bracket 3 is calculated such that it avoids any  
10 interference with the operational devices fastened on the roof of the vehicle, such as aiming, observation, detection, electromagnetic protection or communication devices.

Figures 2a and 2b show the ballistic protection device 1, in its single plate version, in the disengaged position  
15 (Figure 2a) and in its protection position (Figure 2b). The device 1 is fastened onto the turret 10 of an armoured combat or security vehicle by the bracket 3. In its protection position, the plate 7 is positioned above the hatch 11 so as to protect the occupants of the vehicle from attack by a  
20 weapon having high perforating capability.

Figure 3a is a top view of the roof 20 of a vehicle and shows the invention in its double plate version in the disengaged position. In this position, hatches 11 and 12 providing access to the interior of the vehicle are  
25 accessible and may be manoeuvred by the members of the crew. The system incorporates two plates 8 and 9 joined by a connecting structure 21. Armouring elements or plates of a special material to reduce radar or infrared signatures are fastened to these plates.

30 Figures 3b, 4a and 4b show the device according to Figure 3a with the plates having been brought into the protection position by rotation, as explained previously. The surface and shape of the plates 8 and 9 should be organised such that they effectively cover the zones to be protected. The  
35 distance separating the roof plates must be sufficient for the crew to be able to activate the aiming and observation means located at the hatch 12 without being hindered by the plates.

The device according to the invention may be produced incorporating many variants. Thus, the plate may be mounted on the bracket in a removable manner. This arrangement allows the plate to be removed if required for more effective  
5 intervention where necessary on the roof. The bracket may, in this case, be fastened permanently onto the vehicle roof. Another variant would consist in providing as many protection devices as surface elements to be protected. This would reduce the size of the plates to a minimum and would provide  
10 additional protection where necessary.